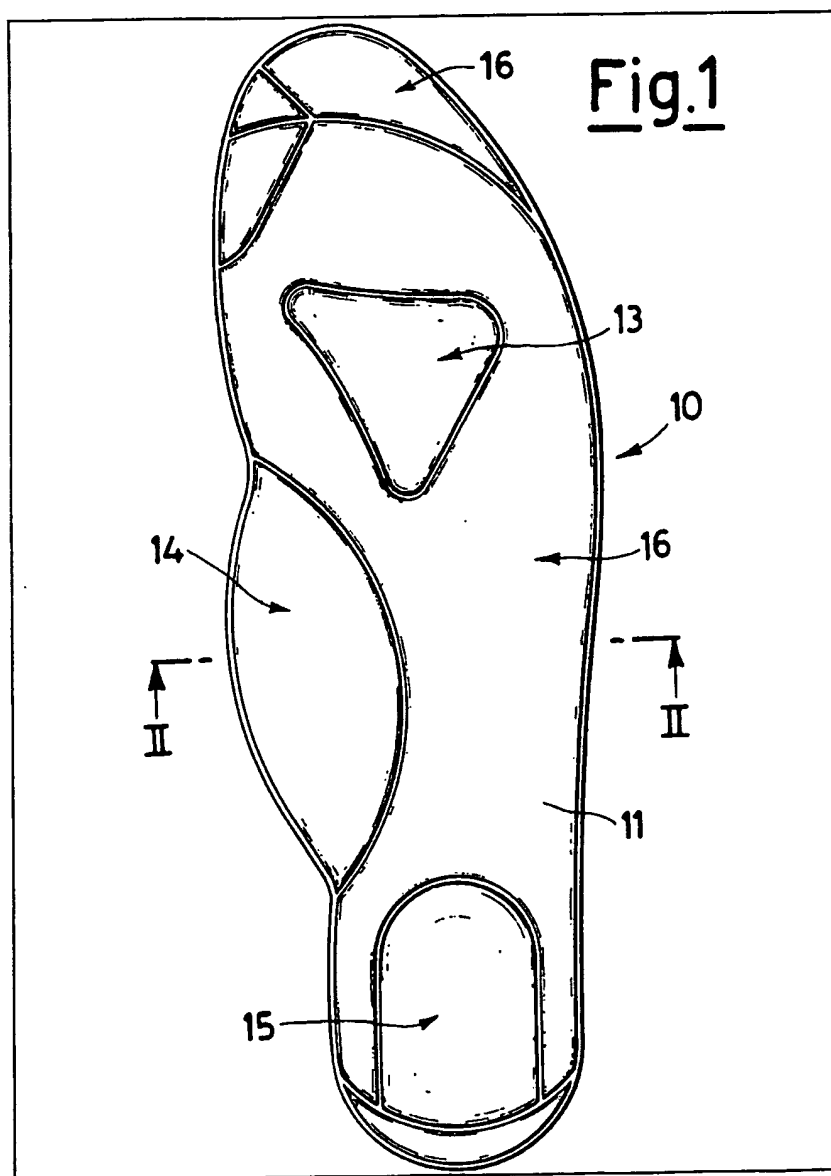


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(54) Air-cushioned Insoles

(57) An insole has sealed air cushions 13, 14, 15 at toe arch and heel respectively, which cushions are of generally the same thickness and thicker than remaining air-cushioned regions 16.



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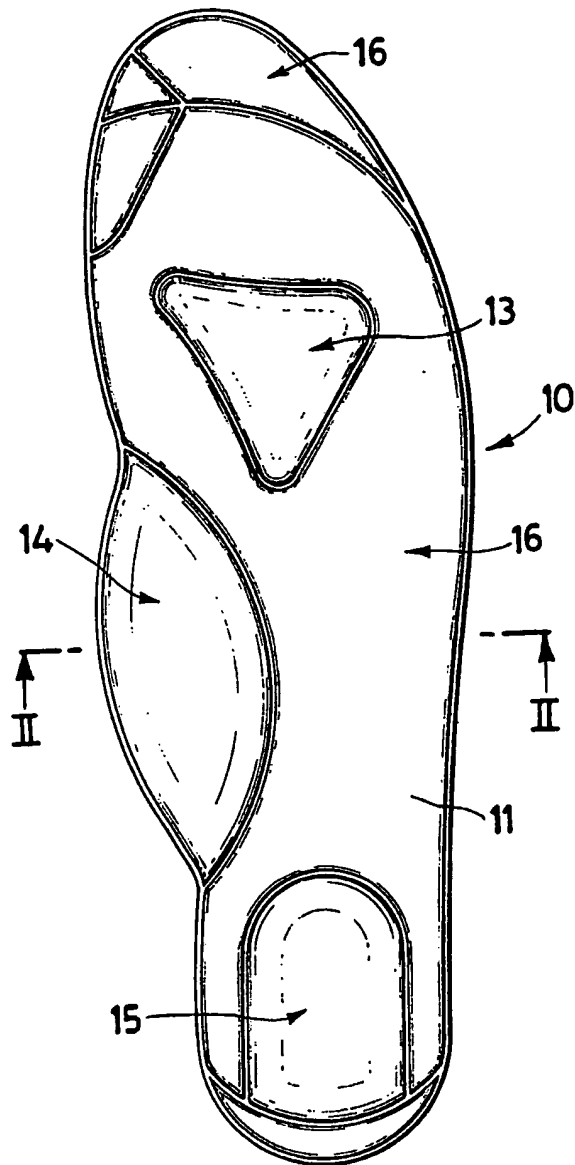
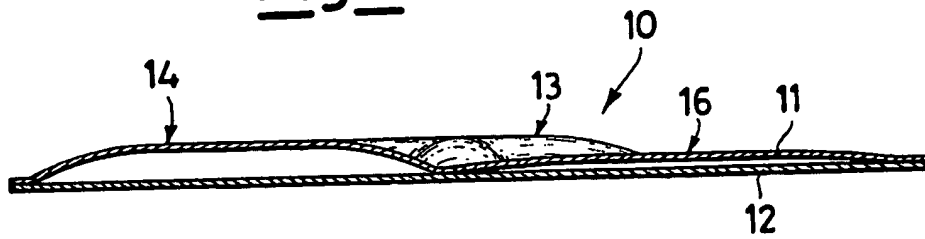
Fig.1Fig.2

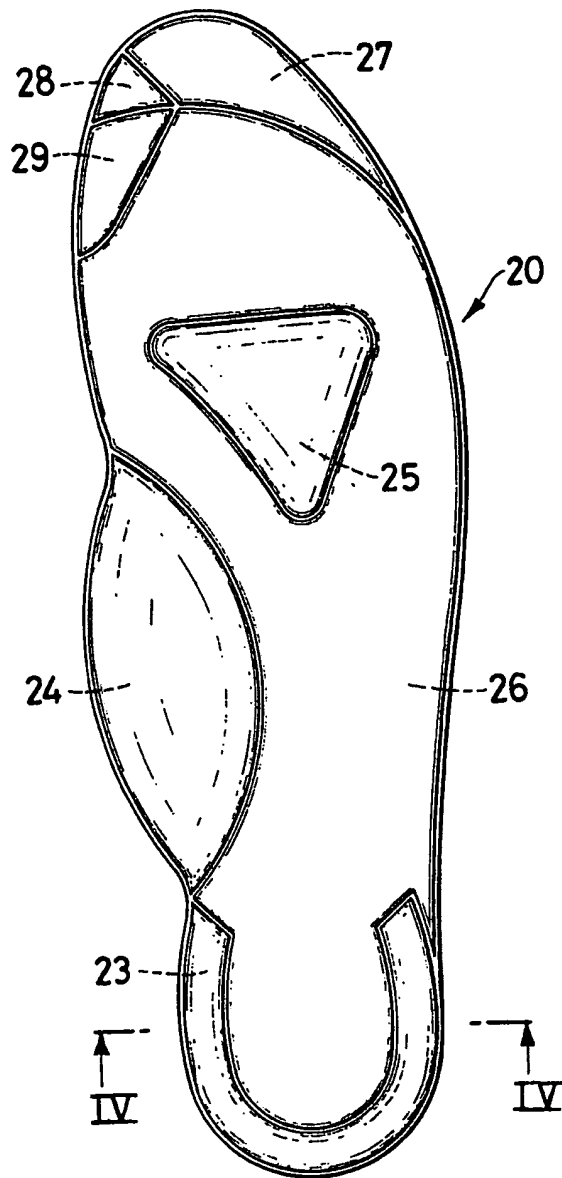
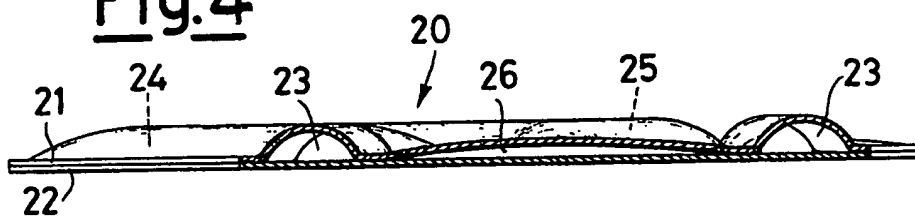
Fig.3Fig.4

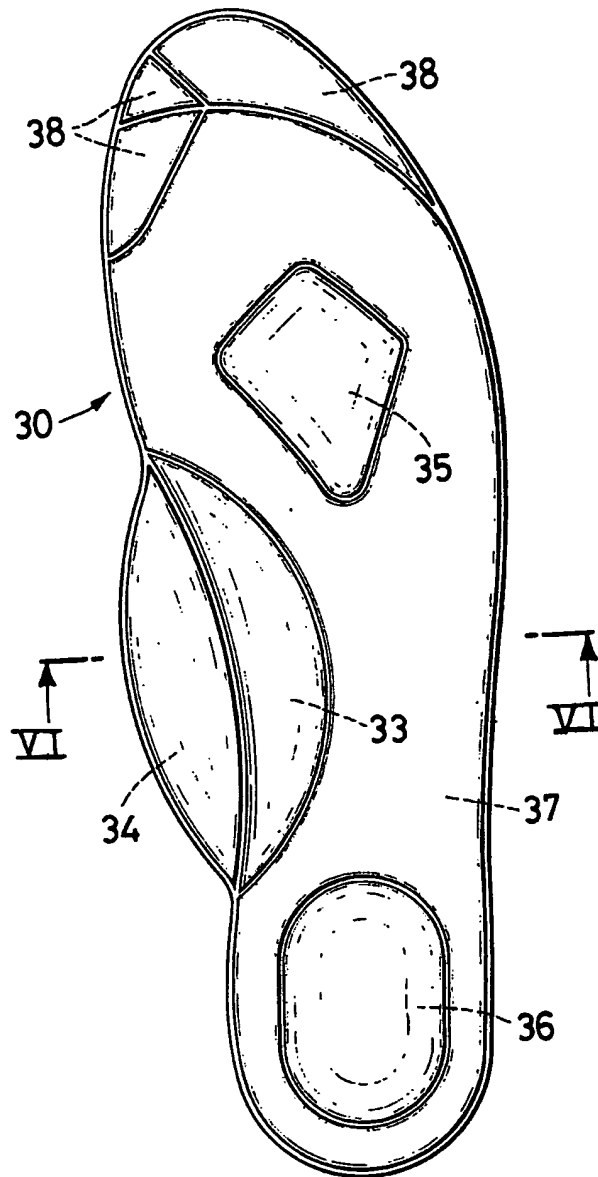
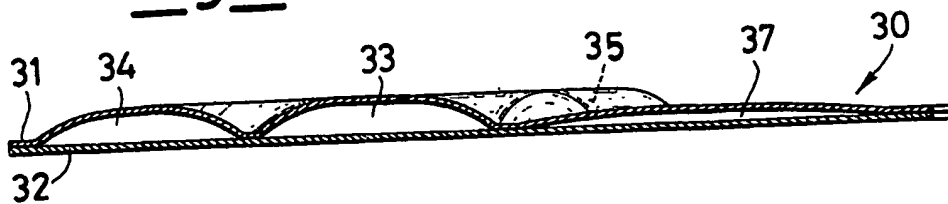
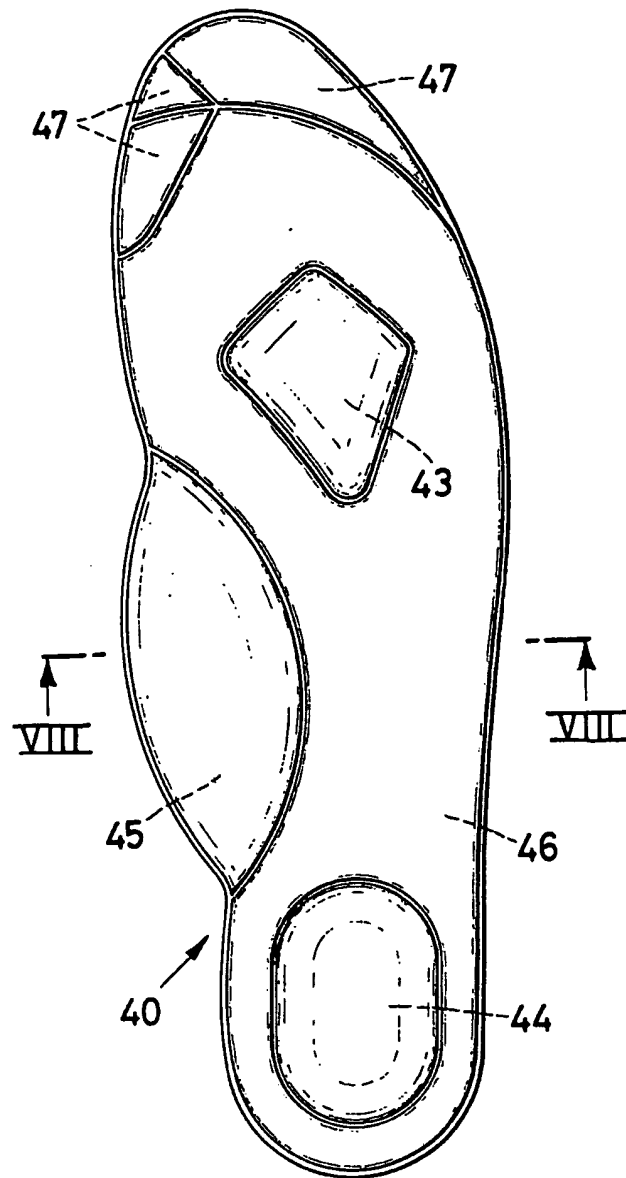
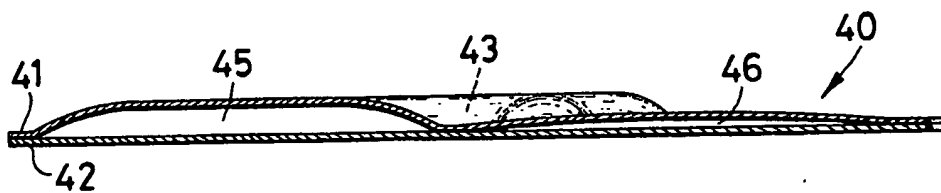
Fig.5Fig.6

Fig.7Fig.8

## SPECIFICATION

## Improvements to air-cushioned insoles

5 There are known insoles consisting of two super-imposed sheets of flexible material between which are formed air-cushions which are in intercommunication for almost the entire length of the foot.

10 The object of said insoles is to ensure that the user can walk in comfort, distributing bodyweight evenly over the entire base surface of the foot.

Such insoles have, however, shown themselves to be inadequate for persons practising sports, the soles of whose feet are subjected at precise points to considerable stresses, and for persons with deformities requiring correction.

For, in the zone most greatly stressed, the air is compressed and is caused at once to occupy the less stressed zones.

20 In this situation, the sole of the foot lacks an adequate, comfortable and corrective support in exactly those zones which are most stressed during the sporting activity.

Moreover, in the known insoles of the aforesaid type, even when ambulation is of the normal kind, the sole of the foot is not assured a reliably stable support because of the more or less compressed air which passes continuously from one cushion to another.

30 A general object of the present invention is to obviate the aforesaid inconveniences by embodying an insole with air-cushions such as will adequately protect all points of the sole of the foot both under effort, as when sporting activities are being carried on, and when ambulation is normal, and such as will correct any deformities of the foot or knee.

40 To this end, according to the invention, there is embodied an insole with air-cushions which is characterized by the fact that it comprises a combination of at least three air-cushions of greater thickness at the toe, the metatarsal arch and the heel of the foot, and also a fourth air-cushion of lesser thickness surrounding the first three.

Another object of the invention is to embody an insole of air-cushion type such as is particularly suitable for persons suffering from calcaneal spur.

50 By the term calcaneal spur is meant an exostosis of the lower surface of the calcaneus which most often starts at the medial tuberosity of the calcaneus from which originate the abductor muscles of the great toe and flexor muscle of the toes, with most of the plantar aponeurosis.

60 The pathogenesis of this circumscribed reactive osseous deformity arises following chronic mechanical over-stress due to a prolonged standing-still posture, excessive bodyweight, flatfoot, and also to simultaneous contraction of the short plantar muscles of the feet and of the plantar aponeurosis at their insertion.

70 The subjects feel an aching pain in the sole which is under load, especially on getting up in the morning. Because of this pain, the tendency is for the foot to support itself on its forepart. If it is allowed that calcaneal spur and the load pains and aches that often accompany it are in the first

instances due to a mechanical over-stressing of the insertions of the tendons and ligaments, then it is seen that usefulness attaches to bringing about a mechanical relief of the rear part of the foot by means of insoles. This relief is engendered by supination of the calcaneus and by accentuating the longitudinal arch of the sole in front of the apex of the spur.

75 The soft parts surrounding the spur must come to rest on a cushioned insole.

According to the present invention, there is consequently embodied an insole featuring at least two air-cushions, the first to support the longitudinal plantar arch, which is thus raised, the second to support the soft parts surrounding the apex of the calcaneal spur in the shape of a horseshoe open at the front in order to prevent load from coming to bear on the spur.

85 The chronic mechanical over-stress at that position is thus relieved to the point of being wholly eliminated, such stress being the root-cause of the spur itself, and a source of pain.

A further object of the present invention is to embody an air-cushioned insole particularly suited to persons suffering from total flatfoot or *pes valgus*.

90 At birth, flatfoot is physiological. With growth, and particularly with the weight of the body on the foot, the relations between the various parts making up the foot alter, and a longitudinal arch is formed with supports at the calcaneus and at the heads of the first and second metatarsals, and a transverse arch is also formed, with supports at the heads of the first and fifth metatarsals.

100 In total flatfoot, both the arches disappear completely. This situation can more easily arise if the person is unduly heavy or if the person's work functionally overloads the feet.

105 The object of the present invention is to prevent the inconveniences described heretofore and, to such end, the invention embodies an insole featuring air-cushions in which, over and above the correction of the transverse arch by the convexed shape of the anterior cushion of the insole supporting the diaphyses of the second, third and fourth metatarsals, there is a correction of the longitudinal arch resulting from a raising of the navicular bone, the cuneiform bones and the first and second metatarsals as a consequence of a definite shape being conferred on the sole by an accentuation of the convexing of an air-cushion in a medial position.

115 Yet another object of the invention is to embody an insole of air-cushion type particularly suitable for persons suffering from fallen transverse arches and metatarsalgia.

120 Flatfoot is characterized by a flattening of the anterior portion of the transverse arch due to supinatory raising of the first radius and dorsal reflexing of the fifth radius.

125 In other cases, because of inflammation or trauma, the median metatarsal heads may fall.

The result of this is a painful resting of one or more metatarsal heads. According to the present invention, there is therefore embodied an air-cushioned insole such as will augment the metatarsal retrocapital thrust. This is achieved by a greater bulging of

the anterior cushion, positioned at the diaphyses of the metatarsals, and by this cushion being extended as far as the heads of the said metatarsal diaphyses.

The said convexing has the effect that, during ambulation, the first and fifth metatarsals are supported and the weight is distributed also over the diaphyses and median metatarsal heads.

The structural and functional characteristics of the invention and its advantages will become even more apparent from the following exemplifying description, referred to the attached drawings, in which:

*Figure 1* is a plan view showing an insole embodied according to the invention;

*Figure 2* is a sectional view in the direction of the line II-II of *Figure 1*;

*Figure 3* is a plan view showing an insole embodied according to the invention suitable for persons suffering from calcaneal spur;

*Figure 4* is an enlarged sectional view in the direction of the line IV-IV of *Figure 3*;

*Figure 5* is a plan view showing an insole embodied according to the invention suitable for persons suffering from total flatfoot or *pes valgus*;

*Figure 6* is an enlarged sectional view in the direction of the line VI-VI of *Figure 5*;

*Figure 7* is a plan view showing an insole embodied according to the present invention suitable for persons suffering from fallen transverse arches and metatarsalgia and

*Figure 8* is an enlarged section according to line VIII-VIII of *Figure 7*.

With reference to *Figures 1 and 2* of the drawings, the insole in question is indicated overall by 10, and comprises two superimposed and attached sheets 11, 12 made of flexible materials.

Characteristically, three separate air-cushions identified as 13, 14 and 15 are formed, of greater thickness, and are surrounded by a fourth air-cushion 16 of lesser thickness.

The air-cushion 13, 14 and 15 relate respectively to the toe of the foot, the metatarsal arch and the heel, while the air-cushion 16 relates to the remaining part of the foot.

It is therefore evident that the zones of the feet most greatly stressed during the carrying on of a sporting activity are protected in an adequate manner by the combination of the aforesaid air-cushions, which at the same time assure a stable support during normal deambulation.

With reference to *Figures 3 and 4* of the drawings, the insole in question is indicated overall by 20, and features air-cushions formed between two superimposed and attached sheets 21, 22 made of flexible materials.

According to the present invention, two air-cushions 23, 24 are formed between said two sheets 21, 22, said air-cushions being of greater and lesser thickness at the heel and at the longitudinal arch of the foot respectively.

The air-cushion 23 has a substantially horseshoe shape, while the air-cushion 24 has a lanceolated-leaf shape.

A third air-cushion 25, of the same thickness as the cushion 24 and disposed centrally in the fore part of the foot, collaborates with said air-cushions 23, 24.

The rest of the insole, that is to say the large air-cushion 26 surrounding the other three, is only slightly inflated, as are also the three sectors 27, 28 and 29 at the toe of the said insole.

With reference to *Figures 5 and 6* of the drawings, the insole in question is indicated overall by 30 and has air-cushions formed between two superimposed and attached sheets 31, 32 made of flexible materials.

According to the present invention there are formed, between said two sheets 31, 32, two adjacent air-cushions 33, 34, of greater and lesser thickness at the longitudinal plantar arch, and there is also formed a third air-cushion 35, having the same thickness as the air-cushion 33, at the fore part of the sole of the foot. The air-cushions 33, 34 have a lanceolated shape while the shape of the air-cushion 35 is rhomboid.

The air-cushion 34 is seen to be external to the profile of the insole.

A fourth air-cushion 36, of the same thickness as the cushion 34 and disposed at the heel of the foot, collaborates with said air-cushions 33, 34 and 35.

The rest of the insole, that is to say the large air-cushion 37 surrounding the others, is only slightly inflated, as are also the three sectors 38 at the toe of the said insole.

With reference to *Figures 7 and 8* of the drawings, the insole in question is indicated overall by 40 and has air-cushions formed between two superimposed and attached sheets 41, 42 made of flexible materials.

According to the invention, between said two sheets and at the fore part, there is formed an air-cushion 43, rhomboid in shape, which is thicker than the air-cushions 44, 45 located at the heel and plantar arch of the foot respectively.

The rest of the insole, that is to say the large air-cushion 46 which surrounds the others, is only slightly inflated, as are also the three sectors 47 at the toe of the said insole.

## CLAIMS

1. An air-cushioned insole characterized in that it comprises a combination of at least three air-cushions of greater thickness at the toe, the metatarsal arch and the heel of the foot respectively, and a fourth air-cushion of lesser thickness which surrounds the first three.

2. An air-cushioned insole according to Claim 1 for persons suffering from calcaneal spur, characterized in that it comprises a first air-cushion of greater thickness having a horseshoe configuration at the heel of the foot, and a second air-cushion at the longitudinal plantar arch having a lanceolated-leaf configuration, said first and second air-cushions being surrounded by other air-cushions intended for the normal support of the other parts of the foot.

3. An air-cushioned insole according to Claim 1 for persons suffering from total flatfoot or *pes valgus*, characterized in that it comprises, at the longitudinal plantar arch, two adjacent air-cushions of lanceolated shape, respectively of greater and lesser thickness, the one of greater thickness being

internal to the profile of the insole and the other  
being external thereto, and, at the fore part, a third  
air-cushion of rhomboid shape and of thickness the  
same as that of the air-cushion of lanceolated shape  
5 internal to the profile of the insole, said air-cushions  
being surrounded by other air-cushions for the  
normal support of the other parts of the foot.

4. An air-cushioned insole according to Claim 1,  
for persons suffering from transverse flatfoot and  
10 metatarsalgia, characterized in that it comprises at  
the fore part an air-cushion of rhomboid shape  
which is thicker than a further two air-cushions at the  
heel and plantar arch respectively, said air-cushions  
being surrounded by other air-cushions for the  
15 normal support of the other parts of the foot.